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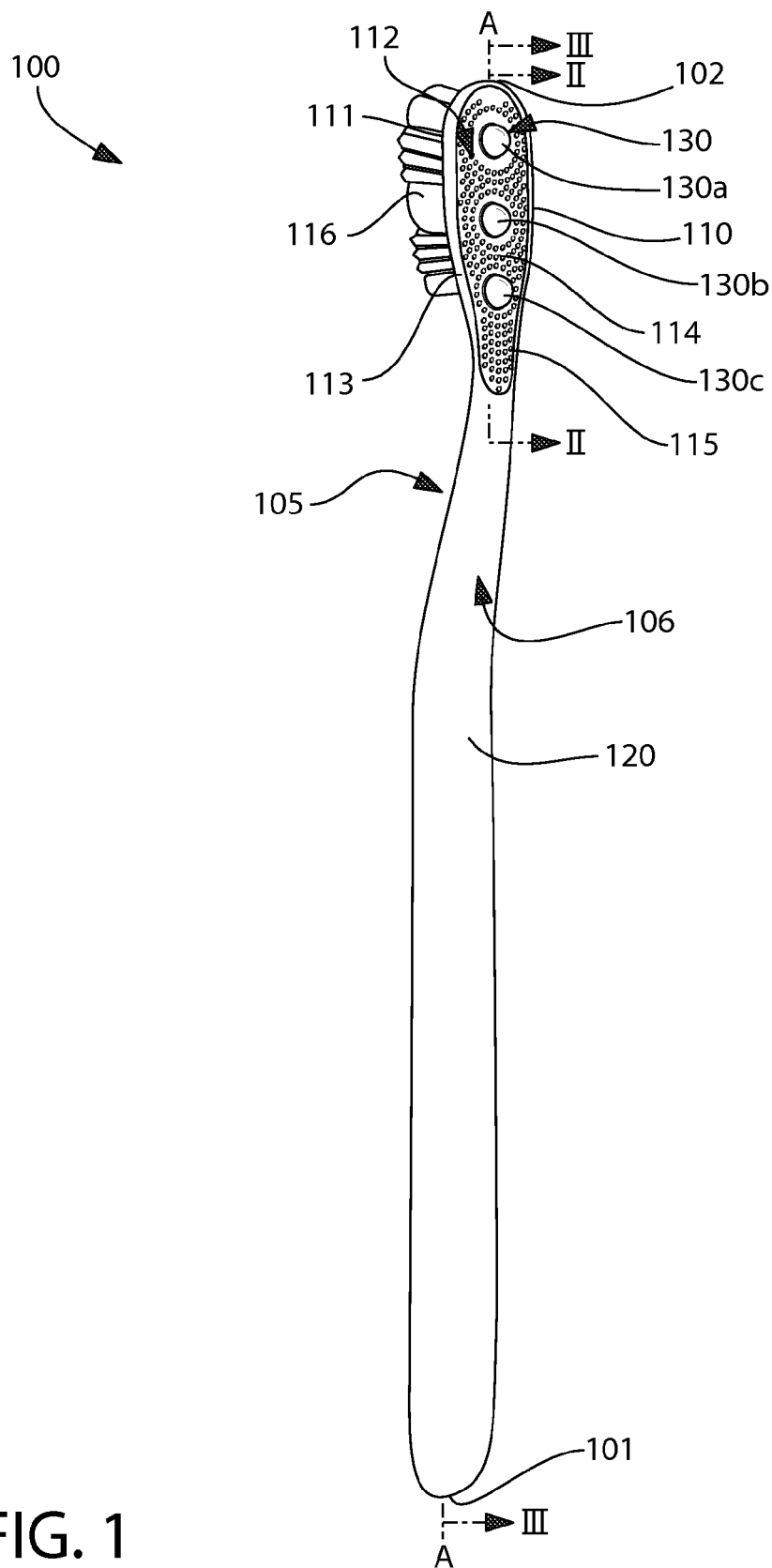


FIG. 1

FIG. 2

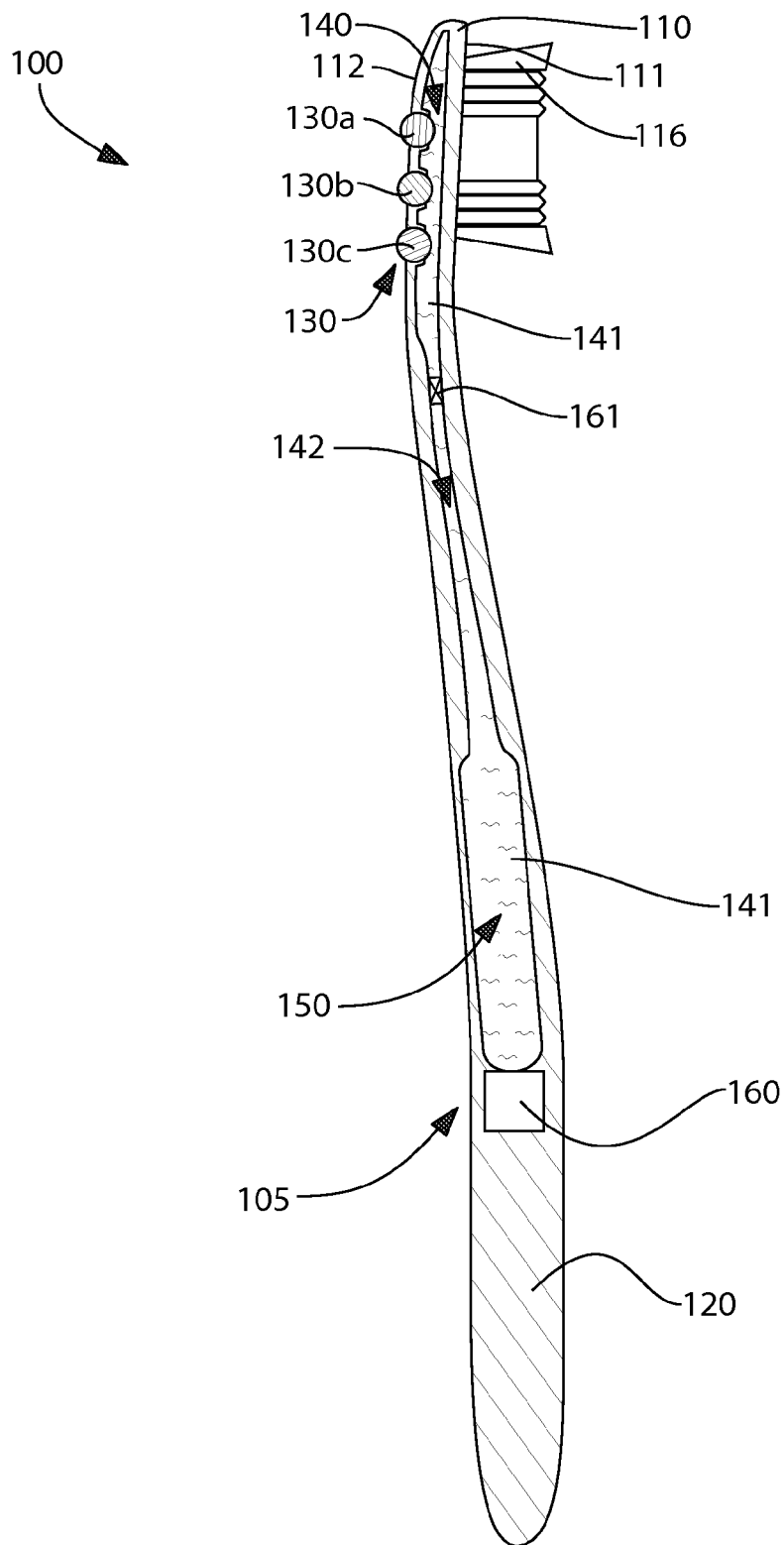


FIG. 3

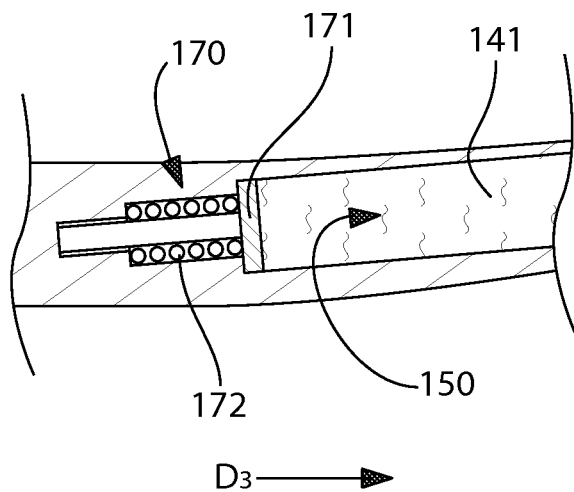


FIG. 3A

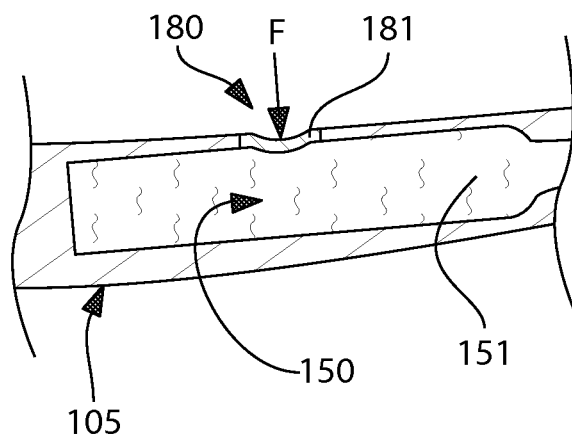


FIG. 3B

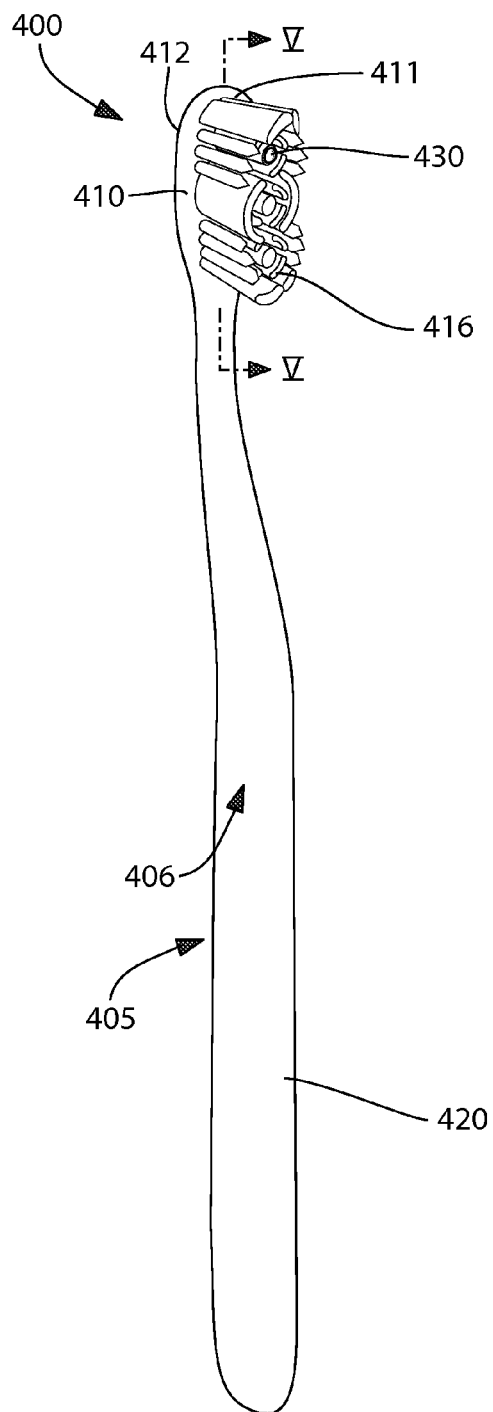


FIG. 4

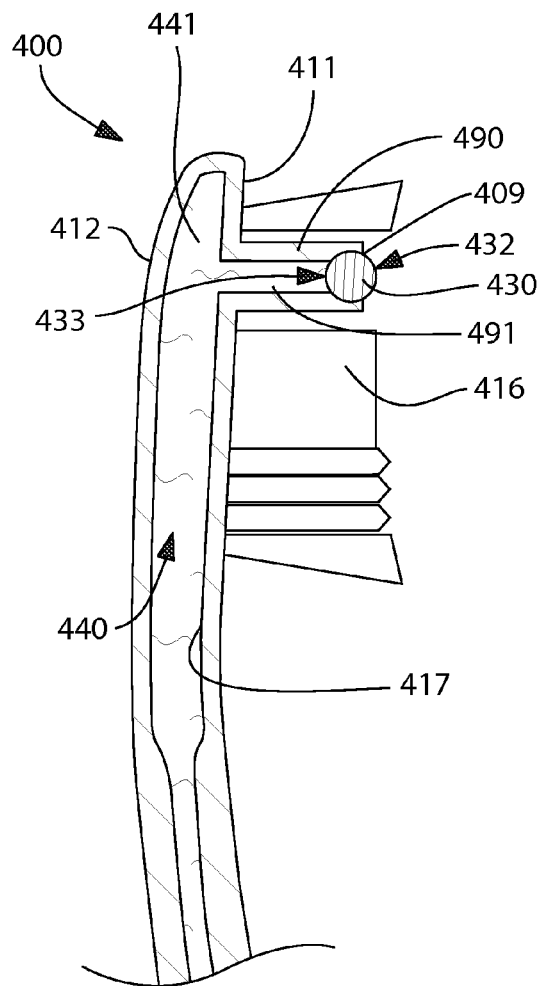


FIG. 5

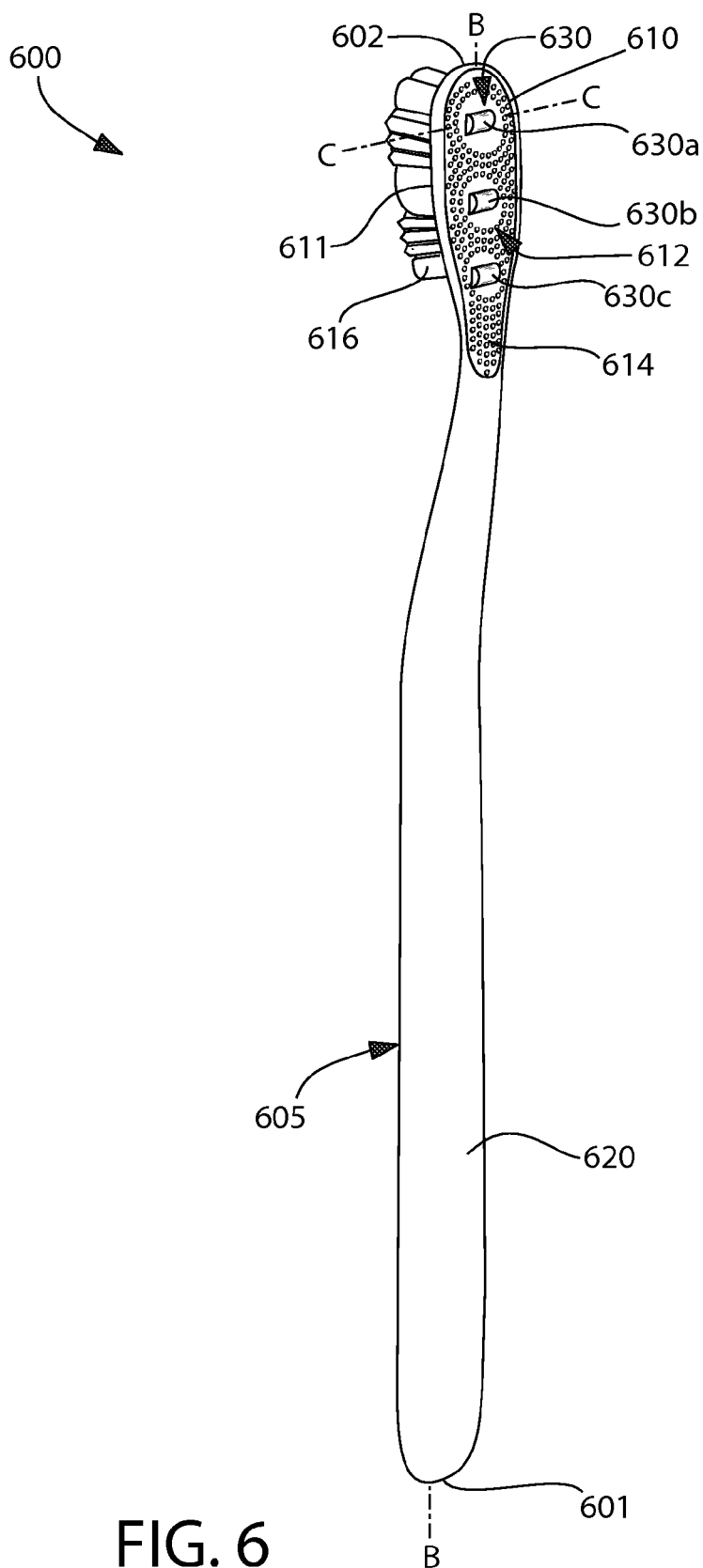


FIG. 6

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ORAL CARE IMPLEMENT HAVING ROLL-ON APPLICATOR

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

The present application is a U.S. national stage application under 35 U.S.C. §371 of PCT Application No. PCT/US2011/030172, filed Mar. 28, 2011, the entirety of which is incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates generally to oral care implements, and more specifically to oral care implements having an oral care material contained therein.

BACKGROUND OF THE INVENTION

Toothbrushes are typically used by applying toothpaste to a bristle section followed by brushing regions of the oral cavity, e.g., the teeth, tongue and/or gums, with the bristle section. Some toothbrushes have been equipped with internal reservoirs and systems for delivering auxiliary oral care materials, such as whitening agents, breath freshening agents and others to a user's oral cavity, in addition to dentifrice. However, in known toothbrushes having oral care material contained therein, the delivery mechanism or channels may become clogged. Such toothbrushes do not adequately deliver the oral care material to a user's oral cavity and can force a user to spend time unclogging the device. Furthermore, some delivery systems utilize either a pump to force the fluid from a reservoir through an opening in a head of the toothbrush or capillary action to flow the oral care material from the reservoir to the head. A stationary applicator, such as a pad or bristles, is then used to apply the oral care material to the oral surface in such known toothbrushes. Thus, a need exists for an improved system for delivering and/or applying an oral care material contained within the oral care implement to a user's oral cavity.

BRIEF SUMMARY OF THE INVENTION

Exemplary embodiments of the invention are directed to oral care implements that have an oral care material contained therein. The oral care implement of the present invention comprises a body having a handle and a head and an internal cavity containing the desired oral care material. The oral care implement of the present invention comprises a roll-on applicator which delivers the oral care material from within the internal cavity to a user's oral surface.

In one embodiment, the invention can be an oral care implement comprising: a body comprising a handle, a head coupled to the handle, and an internal cavity containing an oral care material; and a roll-on applicator rotatably mounted to the body, such that the oral care material is delivered from the internal cavity to an exposed portion of the roll-on applicator due to rotation of the roll-on applicator.

In another embodiment, the invention can be an oral care implement comprising: a body comprising a handle, a head coupled to the handle, and an internal cavity containing an oral care material; and a roll-on applicator rotatably mounted to the body, such that the oral care material is delivered from the internal cavity to an oral surface of a user due to rotation of the roll-on applicator.

Further areas of applicability of the present invention will become apparent from the detailed description provided here-

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inafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. 1 is a rear perspective view of an oral care implement, in the form of a toothbrush, according to one embodiment of the present invention;

FIG. 2 is a longitudinal cross-sectional view of the head of the toothbrush of FIG. 1 taken along line II-II of FIG. 1;

FIG. 3 is a longitudinal cross-sectional view of the toothbrush of FIG. 1 taken along line of FIG. 1, wherein a pressurizer is schematically illustrated;

FIG. 3A is a schematic of one embodiment of a pressurizer in the form of a movable piston that can be used in the toothbrush of FIG. 1 according to one embodiment of the present invention;

FIG. 3B is a schematic of another embodiment of a pressurizer in the form of a compressible wall that can be used in the toothbrush of FIG. 1 according to another embodiment of the present invention;

FIG. 4 is a front perspective view of an oral care implement, in the form of a toothbrush, according to a second embodiment of the present invention, wherein the roll-on applicator is located within the tooth cleaning element field on a front surface of a head;

FIG. 5 is a longitudinal cross-sectional view of the toothbrush of FIG. 4 taken along line V-V of FIG. 4; and

FIG. 6 is a rear perspective view of a toothbrush according to a third embodiment of the present invention, wherein the roll-on applicator is in the form of cylindrical elements.

DETAILED DESCRIPTION OF THE INVENTION

The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

The description of illustrative embodiments according to principles of the present invention is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description. In the description of the exemplary embodiments of the invention disclosed herein, any reference to direction or orientation is merely intended for convenience of description and is not intended in any way to limit the scope of the present invention. Relative terms such as "lower," "upper," "horizontal," "vertical," "above," "below," "up," "down," "left," "right," "top," "bottom," "front" and "rear" as well as derivatives thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description only and do not require that the apparatus be constructed or operated in a particular orientation unless explicitly indicated as such. Terms such as "attached," "affixed," "connected," "coupled," "interconnected," "secured" and similar refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise. Moreover, the features and benefits of the invention are described by reference to the exemplary embodiments illustrated herein. Accordingly, the

invention expressly should not be limited to such exemplary embodiments, even if indicated as being preferred. The discussion herein describes and illustrates some possible non-limiting combinations of features that may exist alone or in other combinations of features. The scope of the invention is defined by the claims appended hereto.

Referring to FIG. 1, a toothbrush 100 in accordance with one embodiment of the present invention is illustrated. In the exemplified embodiments disclosed herein, the invention is illustrated and described in the form of a manual toothbrush. However, the invention is not so limited in all embodiments. In other embodiments, the oral care implement may take other forms, including without limitation a powered toothbrush, an interdental device, a soft tissue cleaner or any other type of ansate oral care implement as is known in the art.

The toothbrush 100 extends from a proximal end 101 to a distal end 102 along a longitudinal axis A-A. The toothbrush 100 generally comprises a body 105 having a head 110 and a handle 120. The body 105 comprises an outer surface 106 and an inner surface 117 (FIG. 2). The body 105 is constructed of a material having suitable rigidity for handling of the toothbrush 100 and being sufficiently impervious to fluids so that an oral care material, such as a fluid, can be stored within an internal cavity 140 and/or a reservoir 150 contained within the body 105 of the toothbrush 100 (discussed below). Suitable materials for the body 105 include hard plastics, such as polyethylene, polypropylene (PP), polyamide, polyester, cel-
lulosics, SAN, acrylic, ABS or any other of the commonly known thermoplastics used in toothbrush manufacture.

The head 110 is coupled to a distal end of the handle 120. In the exemplary embodiment, the head 110 and the handle 120 are integrally formed as a single unitary structure using a molding, milling, machining or other suitable process. However, in other embodiments the handle 120 and the head 110 may be formed as separate components which are operably connected at a later stage of the manufacturing process by any suitable technique known in the art, including without limitation thermal or ultrasonic welding, a tight-fit assembly, a coupling sleeve, threaded engagement, adhesion, or fasteners. Whether the head 110 and the handle 120 are of a unitary or multi-piece construction (including connection techniques) is not limiting of the present invention, unless specifically claimed. In some embodiments of the invention, the head 110 may be detachable (and replaceable) from the handle 120 using techniques known in the art.

The head 110 comprises a front surface 111, a rear surface 112 and a peripheral side surface 113. The front surface 111 and the rear surface 112 of the head 110 can take on a wide variety of shapes and contours, none of which are limiting of the present invention. For example, the front and rear surfaces 111, 112 can be planar, contoured or combinations thereof. While the head 110 is normally widened relative to the neck of the handle 120, it could in some constructions simply be a continuous extension or narrowing of the handle 120.

Moreover, if desired, the rear surface 112 of the head 110 may also comprise additional structures (in addition to an applicator 130, as will be described below) for oral cleaning, such as a soft tissue cleaner 114. The soft tissue cleaner 114 is located on the rear surface 112 of the head 120 and is intended to clean a user's soft tissue surfaces such as the gums, tongue and cheeks. In one embodiment, the soft tissue cleaner 114 is formed of an elastomeric material. The elastomeric material of the soft tissue cleaner 114 may be any biocompatible resilient material suitable for uses in an oral hygiene apparatus. To provide optimum comfort as well as cleaning benefits, the elastomeric material preferably has a hardness property in the range of A8 to A25 Shore hardness. As an example, one

preferred elastomeric material is styrene-ethylene/butylene-styrene block copolymer (SEBS) manufactured by GLS Corporation. Nevertheless, SEBS material from other manufacturers or other materials within and outside the noted hardness range could be used.

The soft tissue cleaner 114 comprises a plurality of protuberances, in the form of nubs 115, extending therefrom. As used herein a "nub" generally refers to a column-like protrusion (without limitation to the cross-sectional shape of the protrusion) which is upstanding from a base surface. In a general sense, the nub 115, in the preferred construction, has a height that is greater than the width at the base of the nub 115 (as measured in the longest direction). Nevertheless, nubs could include projections wherein the widths and heights are roughly the same or wherein the heights are somewhat smaller than the base widths. Moreover, in some circumstances (e.g., where the nub tapers to a tip or includes a base portion that narrows to a smaller projection), the base width can be substantially larger than the height.

In one preferred arrangement of the soft tissue cleaner 114, the nubs 115 are preferably conically shaped. As used herein, "conically shaped" or "conical" is meant to include true cones, frusto-conically shaped elements, and other shapes that taper to a narrow end and thereby resemble a cone irrespective of whether they are uniform, continuous in their taper, or have rounded cross-sections. An example of a suitable elastomeric soft tissue cleaner that may be used with the present invention and positioned on the rear surface 112 of the head 110 is disclosed in U.S. Pat. No. 7,143,462, issued Dec. 5, 2006 to the assignee of the present application, the entirety of which is hereby incorporated by reference. The soft tissue cleaner 114 is omitted from illustration in FIGS. 2-5 to prevent crowding in the figures and for ease of description. However, it should be understood that the soft tissue cleaner 114 can be included with any of the embodiments discussed herein.

In certain other embodiments, the protuberances of the soft tissue cleaner 114 can take the form of elongated ridges, nubs, or combinations thereof. Moreover, in certain embodiments, the soft tissue cleaner 114 can be formed out of the same material of the body 105 as discussed above. In one such embodiment, the soft tissue cleanser 114 can comprise protuberances that are integrally formed into the body 105.

The head 110 also comprises a plurality of tooth cleaning elements 116 extending from the front surface 111. The plurality of tooth cleaning elements 116 conceptually forms a field of cleaning elements. The tooth cleaning elements 116 are generically illustrated as a plurality of tufts of bristles. However, the invention is in no way limited by the configuration or material of the tooth cleaning elements 116. Furthermore, while the plurality of tooth cleaning elements 116 are particularly suited for brushing and/or polishing teeth, the plurality of tooth cleaning elements 116 can also be used to clean oral soft tissue, such as a tongue, gums, or cheeks instead of or in addition to teeth. As used herein, the term "tooth cleaning elements" is used in a generic sense to refer to any structure that can be used to clean, polish or wipe the teeth and/or soft oral tissue (e.g. tongue, cheek, gums, etc.) through relative surface contact. Common examples of tooth cleaning elements include, without limitation, bristle tufts, filament bristles, fiber bristles, nylon bristles, spiral bristles, rubber bristles, elastomeric protrusions, flexible polymer protrusions, combinations thereof and/or structures containing such materials or combinations. Suitable elastomeric materials include any biocompatible resilient material suitable for uses in an oral hygiene apparatus as have been described in detail above with regard to the soft tissue cleaner 114.

The plurality of tooth cleaning elements **116** can be mounted to the head **110** in any manner known in the art. For example, staples/anchors, in-mold tufting (IMT) or anchor free tufting (AFT) could be used to mount the cleaning elements/tooth engaging elements. In AFT, a plate or membrane is secured to the brush head such as by ultrasonic welding. The bristles extend through the plate or membrane. The free ends of the bristles on one side of the plate or membrane perform the cleaning function. The ends of the bristles on the other side of the plate or membrane are melted together by heat to be anchored in place. Any suitable form of cleaning elements may be used in the broad practice of this invention. Alternatively, the bristles could be mounted to tuft blocks or sections by extending through suitable depressions in the tuft blocks so that the base of the bristles is mounted within or below the tuft block.

Referring now to FIGS. 1 and 2 concurrently, the toothbrush **100** further comprises a roll-on applicator **130** rotatably mounted to the body **105** of the toothbrush. In the exemplified embodiment, the roll-on applicator **130** is rotatably mounted to the body **105** so as to be positioned on the rear surface **112** of the head **110** of the toothbrush **100**. However, the invention is not so limited and in other embodiments (some of which will be described below), the roll-on applicator **130** can be rotatably mounted to the body **105** so as to be positioned on the front surface **111** of the head **110**. In still other embodiments, the roll-on applicator **130** can be rotatably mounted to the body **105** so as to be positioned on the handle **120**, such as for example at or near the proximal end **101** of the toothbrush **100**. Of course, the roll-on applicator **130** can rotatably mounted to the body **105** so as to be positioned still elsewhere on the body **105**, including on the narrowed neck portion of the toothbrush **100** (which is located between the handle **120** and the head **110**).

In the exemplified embodiment, the roll-on applicator **130** is positioned within the soft tissue cleaner **114**. In other words, the roll-on applicator **130** is positioned within a field of the protuberances of the soft tissue cleaner **114**. In one embodiment, the roll-on applicator **130** is positioned within the field of the protuberances of the soft tissue cleaner **114** so as to be circumferentially surrounded by the protuberances. In still other embodiments, the roll-on applicator **130** is positioned within the field of the protuberances of the soft tissue cleaner **114** so that the protuberances of the soft tissue cleaner **114** are located on at least opposite sides of the roll-on applicator **130** measured along the longitudinal axis A-A.

In the exemplified embodiment of FIGS. 1-2, the roll-on applicator **130** comprises a plurality of rolling elements, which are illustrated as spherical elements **130a-c**. While three rolling elements are exemplified, more or less than three rolling elements can be utilized as desired. Of course, in other embodiments, the roll-on applicator **130** may comprise a single rolling element. In the exemplified embodiment, the rolling elements are in the form of a first spherical element **130a**, a second spherical element **130b** and a third spherical element **130c**. Each of the spherical elements **130a-c** is capable of 360 degree rotation about each of the X, Y and Z axes in a Cartesian coordinate system such that there is no limit on the angle and/or degree of rotation of the spherical elements **130a-c**. Although the rolling elements of the roll-on applicator **130** are exemplified and described herein as spherical elements **130a-c**, the rolling elements of the roll-on applicator **130** can take on many other three-dimensional geometries so long as the rolling elements are capable of a sufficient degree of rotation to deliver oral care material from an internal cavity and/or reservoir to the user's oral surface. Thus, the

structural cooperation and concepts discussed below can be applied to any type of rolling element that is used as the roll-on applicator **130**.

The spherical elements **130a-c** are solid in the exemplified embodiment but can be hollow in other embodiments. The spherical elements **130a-c** can be formed of a wide variety of materials, including rigid materials, elastomeric materials, or combinations thereof. In certain embodiments, the spherical elements **130a-c** can be formed of hard plastics such as polypropylene or any of the other materials described above for the body **105**. Alternatively, the spherical elements **130a-c** may be formed of a metallic material such as, for example without limitation steel, aluminum, copper or the like. In still other embodiments, the spherical elements **130a-c** can be formed of thermoplastic elastomers having a high degree of Shore A hardness.

The outer surfaces of the spherical elements **130a-c** are smooth in the exemplified embodiment to provide comfort to a user as well as to facilitate ease of rotation. However, in certain other embodiments, the outer surfaces of the spherical elements **130a-c** may be roughened or may contain an irregular topography. Such embodiments may enhance the delivery of an oral care material to a user's oral surfaces as will be described in detail below.

Each one of the spherical elements **130a-c** is rotatably mounted to the rear surface **112** of the head **110** so as to be isolated from one another. In other words, each of the spherical elements **130a-c** can function independent of the other ones of the spherical elements **130a-c**. Thus, if one spherical element **130a-c** were to become clogged or incapable of rotation, the other spherical elements **130a-c** would continue to deliver the oral care material to the desired oral surface of the user during use.

In order to rotatably mount the spherical elements **130a-c** to the body **105**, the rear surface **112** of the head **110** comprises a first socket **131a**, a second socket **131b** and a third socket **131c**. The first spherical element **130a** is rotatably mounted in the first socket **131a**, the second spherical element **130b** is rotatably mounted in the second socket **131b** and the third spherical element **130c** is rotatably mounted in the third socket **131c**. Each one of the sockets **131a-c** forms a passage-way from the external environment, through a wall of the body **105** and into an internal cavity **140** of the body **105**. As a result, each one of the sockets **130a-c** comprises a respective opening **108a**, **108b**, **108c** at the inner surface **117** of the body **105** and a respective opening **109a**, **109b**, **109c** at the outer surface **106** of the body **105**. When rotatably mounted within their corresponding sockets **131a-c**, the spherical elements **130a-c** are simultaneously exposed to both the external environment and the internal cavity **140** of the body **105**. In the exemplified embodiment, a portion of each of the spherical elements **130a-c** protrudes from the openings **108a-c** while another portion of the spherical elements **130a-c** protrudes from the openings **109a-c**.

The spherical elements **130a-c** can be rotatably mounted within the sockets **131a-c** in a wide variety of manners so long as the spherical elements **130a-c** are retained within the sockets **131a-c** and capable of the desired rotation. In the exemplified embodiment, the spherical elements **130a-c** are retained within the sockets **131a-c** due to a geometric mating between side-wall surfaces **134a-c** of the sockets **131a-c** and the spherical elements **130a-c**. More specifically, each of the sockets **131a-c** is defined by a contoured side-wall surface **134a-c**. These contoured side-wall surfaces **134a-c** have a concave contour that generally corresponds to the convex contour of the outer surfaces of the spherical elements **130a-c**. Of course, the contours are selected so as to allow for the

necessary tolerance required to allow rotation. As such, the convex contour of the outer surface of each of the spherical elements **130a-c** nests within the concave contour of the side-wall surface **134a-c** of the corresponding socket **131a-c**. In other embodiments, the spherical elements **130a-c** can be rotatably mounted within the sockets **131a-c** using an axle or pivot pins.

The spherical elements **130a-c** are rotatably mounted on the rear surface **112** of the head **110** in a spaced apart manner. In the exemplified embodiment, the first spherical element **130a** is spaced from the second spherical element **130b** a first distance **D1** and the second spherical element **130b** is spaced from the third spherical element **130c** a second distance **D2** such that the first and second distances **D1**, **D2** are the same. However, in certain other embodiments the first and second distances **D1**, **D2** may be different in order to achieve a particular cleaning action. In the exemplified embodiment, the spherical elements **130a-c** are aligned along the longitudinal axis **A-A**. Of course, the invention is not to be so limited and in certain other embodiments the spherical elements **130a-c** can be aligned along an axis that is transverse or oblique to the longitudinal axis **A-A**. In still other embodiments, the spherical elements **130a-c** could be located along an axis that is substantially parallel to but offset from the longitudinal axis **A-A**. In another embodiment, the spherical elements **130a-c** may be rotatably mounted the peripheral surface **113** of the head **110**. Unless specifically recited in the claims, the invention is not to be limited by the particular arrangement, number and/or positioning of the rolling elements.

The internal cavity **140** is defined by the inner surface **117** of the body **105** of the toothbrush **100**. In the exemplified embodiment, the internal cavity **140** is located within the head **110** of the toothbrush **100**. However, in other embodiments, the internal cavity **140** can be positioned at other locations within the body **105**. For example, in other embodiments, the internal cavity **140** can be located in the handle **120** and/or the neck region of the toothbrush **100**. The internal cavity **140** contains an oral care material **141** therein. Thus, the body **105** forms a housing which forms the internal cavity **140** which contains the oral care material **141**. In certain embodiments, the toothbrush **100** also comprises a delivery channel **142** that places the internal cavity **140** in fluid communication with a reservoir **150** (described below). However, in certain other embodiments, the internal cavity **140** is an isolated chamber and the toothbrush **100** may not include a delivery channel **142** or a separate reservoir **150**. In such an embodiment, the internal cavity **140** will act as a reservoir.

The oral care material **141** is a material that provides oral health benefits to a user upon contact with a user's oral cavity. In one embodiment, the oral care material **141** is a fluidic material. For example, in certain embodiments the oral care material **141** is a mouthwash solution that cleans the oral surfaces when applied thereto and provides the user with breath freshening benefits. In other embodiments, the oral care material **141** is a tooth cleaning solution. Of course, the oral care material **141** is not to be in any way limiting of the present invention and may include fluids having active or inactive agents that deliver therapeutic, cosmetic, experiential and/or sensorial benefits to a consumer during a tooth, soft tissue, tongue or interdental cleaning regimen. Specifically, the oral care material can be an anti-sensitivity agent, fluoride, a tartar protection agent, an antibacterial agent, an oxidative or whitening agent, an enamel strengthening or repair agent, a tooth erosion preventing agent, a tooth sensitivity ingredient, a gum health active, a nutritional ingredient, a tartar control or anti-stain ingredient, an enzyme, a sensate

ingredient, a flavor or flavor ingredient, a breath freshening ingredient, an oral malodor reducing agent, an anti-attachment agent or sealant, a diagnostic solution, an occluding agent, a dry mouth relief ingredient, a catalyst to enhance the activity of any of these agents, colorants or aesthetic ingredients, arginine bicarbonate, chlorohexidine, triclosan, CPC, zinc oxide and combinations thereof. In certain embodiments, the oral care material **141** is free of a dentifrice as the oral care material **141** is intended to supplement traditional brushing of the teeth rather than supplant it.

As discussed above, the spherical elements **130a-c** of the roll-on applicator **130** are mounted to the rear surface **112** of the head **110** within the sockets **131a-c** on the rear surface **112** of the head **110**. The spherical elements **130a-c** are mounted to the head **110** so that a portion of each of the spherical elements **130a-c** protrudes through the corresponding opening **108a-c** in the inner surface **117** of the body **105** and is in contact with the oral care material **141** within the internal cavity **140**. Another portion of each of the spherical elements **130a-c** protrudes through the corresponding opening **109a-c** in the outer surface **106** of the body **105** and is exposed to the external environment. Thus, as will be described in detail below, each of the spherical elements **130a-c** comprises an exposed portion that protrudes from the outer surface **106** of the body for applying the oral care material to the user's oral surface. As the spherical elements **130a-c** rotate within their respective sockets **131a-c**, the oral care material **141** is delivered from the internal cavity **140** to the exposed portions of the spherical elements **130a-c**.

The functional details of the spherical elements **130a-c** will now be described with respect to the first spherical element **130a** with the understanding that the below-discussion is equally applicable to the other two spherical elements **130b-c** and any other structural embodiment which the rolling element may take form.

The first spherical element **130a** comprises an exposed portion **132a** and an internal portion **133a**. The exposed portion **132a** protrudes from the outer surface **106** of the body **105** (which in the exemplified embodiment is the rear surface **112** of the head **110**) while the internal portion **133a** is positioned within the internal cavity **140** and in contact with the oral care material **141** therein. It should be understood that the exposed portion **132a** and the internal portion **133a** of the first spherical element **130a** are not a particular segment/area of the first spherical element **130a** itself but are rather defined by the relative positioning with respect to the body **105** and/or external environment. Thus, the segments/areas of the first spherical element **130a** that make up the exposed and internal portions **132a**, **133a** change during rotation of the first spherical element **130a**. Moreover, during rotation of the spherical element **130a**, the particular segment/area of the first spherical element **130a** that forms the exposed portion **132a** of the first spherical element **130a** at a certain time may also form the internal portion **133a** of the first spherical element **130a** at a different time. As the spherical element **130a** is rotated due to frictional contact with the oral surface, the oral care material **141** within the internal cavity **140** adheres to the segment/area of the spherical element **130a** that is, at that time, the internal portion **133a**. As the spherical element **130a** continues to rotate, the segment/area of the spherical element **130a** having the oral care material **141** adhered thereto becomes the exposed portion **132a** of the spherical element **130a** (at a subsequent time), thereby allowing the adhered oral care material **141** to be applied to the desired oral surface.

In the exemplified embodiment, the first spherical element **130a** comprises an exposed portion **132a** that protrudes from the outer surface **106** of the body **105** and an internal portion

133a that is in contact with the oral care material **141** within the internal cavity **140**. Similarly, the second spherical element **130b** also comprises an exposed portion **132b** and an internal portion **133b** while the third spherical element **130c** comprises an exposed portion **132c** and an internal portion **133c**.

As set forth above, the roll-on applicator **130** delivers the oral care material **141** from the internal cavity **140** to the exposed portions **132a-c** of the spherical elements **130a-c** due to rotation of the spherical elements **130a-c** during use of the toothbrush **100**. The adherence of the oral care material **141** to the spherical elements **130a-c** can be the result of the tackiness of the oral care material **141**, a capillary action, and/or surface tension between the oral care material **141** and the spherical elements **130a-c**. When a user desires to dispense the oral care material **141** from the internal cavity **140** to an oral surface, the exposed portions **132a-c** of the spherical elements **130a-c** are first put into contact with the desired oral surface. The toothbrush **100** is then translated. Due to the frictional engagement between the exposed portions **132a-c** of the spherical elements **130a-c** and the oral surface, the spherical elements **130a-c** rotate during said translation, thereby dispensing the oral care material **141** onto the oral surface. This dispensing can occur indirectly during brushing of the teeth or be specifically intended, such as brushing of the tongue with the rear surface **112** of the head **110**. The spherical elements **130a-c** will continue to rotate throughout use of the toothbrush **100** so that fresh oral care material **141** will continually be delivered from the internal cavity **140** to the exposed portions **132a-c** of the spherical elements **130a-c** for application to the user's oral cavity. As discussed in above, each of the spherical elements **130a-c** is capable of 360 degree rotation about each of the X-axis, Y-axis and Z-axis of the Cartesian coordinate system, wherein the center of the subject spherical elements **130a-c** is considered the 0-0-0 point. However, such unlimited degrees of rotational freedom are not necessary in all embodiments of the invention. In certain embodiments, the rolling element(s) of the roll-on applicator **130** will have at least 360 degrees of rotational freedom about at least a single axis. In one such embodiment, this single axis may be substantially perpendicular to the longitudinal axis A-A of the toothbrush **100**.

Referring now to FIGS. 1 and 3 concurrently, the toothbrush **100** and its internal structure and components will be described in greater detail. In the exemplified embodiment, the body **105** further comprises a reservoir **150** that contains an additional amount of the oral care material **141**. The reservoir **150** is in fluid communication with the internal cavity **140**. However, as mentioned above, in certain embodiments the internal cavity **140** may be the only chamber within the body **105** that contains the oral care material **141** and, thus, can conceptually be considered a reservoir in such embodiments.

The delivery channel **142** extends from the reservoir **150** to the internal cavity **140**, thereby forming a passageway from the reservoir **150** to the internal cavity **140** that facilitates the fluid communication between the reservoir **150** and the internal cavity **140**. In the exemplified embodiment, the delivery channel **142** extends axially along the longitudinal axis A-A. In other embodiments, the delivery channel **142** may extend substantially transverse or at an oblique angle to the longitudinal axis A-A. The delivery channel **142** may be linear, curved, and/or combinations thereof. The exact shape and orientation of the delivery channel **142** will be dictated by considerations such as the position of the internal cavity **140**, the position of the reservoir **150**, and the shape of the body **105**. While the internal cavity **140** is shown as being a larger

chamber than the delivery channel **142** in cross-section, in certain alternate embodiments the internal cavity **140** can be merely a portion of the delivery channel **142**.

The toothbrush **100** further comprises a pressurizer **160** for maintaining the oral care material **141** in contact with the spherical elements **130a-c** of the roll-on applicator **130**. In the exemplified embodiment, the pressurizer **160** is operably coupled to the reservoir **150**. However, in other embodiments, the pressurizer **160** can be operably coupled directly to the internal cavity **140** or to the delivery channel **142**.

The pressurizer **160** can be any type of pressurizer known in the art, such as for example without limitation a movable piston or a user-operable pump. Examples of user-operated pumps include a compressible bladder, an electrical pump, a manual pump, a gas-generating cell. The pressurizer **160** is operated by the user to increase the pressure within the reservoir **150**, which in turn forces the oral care material **141** to flow from the reservoir **150** to the internal cavity **140**, thereby continually supplying and filling the internal cavity **140** with the oral care material **141**. Thus, by pressurizing the oral care material **141** within the reservoir **150**, the pressurizer **160** also indirectly pressurizes the internal cavity **140** due to the fluid communication between the reservoir **150** and the internal cavity **140**.

The pressurizer **160** ensures that the internal cavity **140** remains filled with the oral care material **141** so that the internal portions **133a-c** of the spherical elements **130a-c** of the roll-on applicator **130** are maintained in contact with the oral care material **141** at all times. If the internal cavity **140** becomes empty and devoid of the oral care material **141**, the roll-on applicator **130** will no longer be able to deliver the oral care material **141** to the user's oral surfaces. Thus, the pressurizer **160** ensures that the internal cavity **140** remains filled with the oral care material **141** so that the roll-on applicator **130** remains in contact with the oral care material **141** for delivery.

In the exemplified embodiment, the toothbrush **100** further comprises a one-way valve **161** that is positioned in the delivery channel **142**. Of course, the invention is not to be so limited and the one-way valve **161** can be positioned at other locations along the fluid path within the body **105**. In one embodiment, it is simply preferred that the one-way valve be operably coupled between the reservoir **150** and the internal cavity **140**. Thus, the one-way valve **161** can be positioned at an exit point of the reservoir **150** or at an entrance point of the internal cavity **140** or at any location therebetween. The one-way valve **160** permits the oral care material **141** to flow from the reservoir **150** to the internal cavity **140** while preventing or prohibiting the oral care material **141** from flowing from the internal cavity **140** into the reservoir **150**. Thus, the one-way valve **161** also ensures that the internal cavity **140** remains filled so that the roll-on applicator **130** can maintain contact with the oral care material **141** within the internal cavity **140**.

When the amount of the oral care material **141** within the internal cavity **140** becomes low or depleted, the oral care material **150** within the reservoir **150** can be forced into the internal cavity **140** via automated or user-operated activation the pressurizer **160**. The oral care material **141** is maintained within the internal cavity **140** due to the existence of the one-way valve **161**. Thus, the reservoir **150** contains an additional supply of the oral care material **141** to enable the toothbrush **100** to continue operating as desired even after an initial supply of the oral care material **141** within the internal cavity **140** has been depleted.

While the foregoing description discusses a single internal cavity **140**, a single delivery channel **142**, and a single reser-

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voir 150, in certain embodiments, multiple internal cavities, multiple delivery channels, and multiple reservoirs may be provided such that different oral care materials may be provided via the spherical elements 130a-c.

Turning to FIG. 3A, one particular example of a pressurizer 170 will be described. The pressurizer 170 comprises a movable piston 171 that forces the oral care material 141 from the reservoir 150 to the internal cavity 140. In the exemplified embodiment, the pressurizer 170 includes a biasing member 172 that provides a constant pressure on the reservoir 150 and reduces the volume of the reservoir 150 as the oral care material 141 is dispensed. In the exemplified embodiment, the biasing member 172 is a coil spring. In other embodiments, the biasing member 172 can be any type of resilient component, including without limitation different types of springs, elastomeric elements, resilient prongs and/or combinations thereof. As the oral care material 141 within the internal cavity 140 becomes depleted, the biasing member 172 will extend in an axial direction D3. As the biasing member 172 extends in the axial direction D3, the piston 171 also moves in the axial direction D3 and thereby decreases the interior volume of the reservoir 150. Thus, the piston 171, which is in constant contact with the oral care material 141, forces the oral care material 141 to migrate in the axial direction D3 towards the internal cavity 140. The biasing member 172 and piston 171 only move in the axial direction D3 as the oral care material 141 is removed from the internal cavity 140 as a result of usage of the toothbrush 100. It is preferred that the force of the biasing member 172, such as the spring force, is selected so as to prevent weeping or discharge of the oral care material 141 through the dispensing gap between the spherical elements 130a-c and the side-walls of the corresponding sockets 131a-c. It should be understood that in embodiments that have the pressurizer 170, the one-way valve 161 may be omitted because the volume of the reservoir 150 decreases as the piston 171 moves in the axial direction D3. Decreasing the volume of the reservoir 150 prevents the oral care material 141 from flowing from the internal cavity 140 back to the reservoir 150 because of the corresponding decrease in volume of the reservoir 150.

In other embodiments using a movable piston 171 as part of the pressurizer 170, the movable piston 171 can be translated either manually or electronically due to user actuation. For example, a ratchet or drive screw assembly could be used.

Referring now to FIG. 3B, an exemplary pressurizer 180 will be described. The pressurizer 180 is illustrated as a user-operable manual pump. Specifically, the pressurizer 180 is formed by a compressible portion 181 of the body 105 that is formed of a compressible material. The compressible material may be a resilient material, such as an elastomeric material, a flexible plastic material or the like. As the oral care material 141 within the internal cavity 140 becomes depleted, a user can press down on the compressible portion 181 of the body 105 with a transverse force F in the direction of the arrow, thereby forcing the oral care material 141 within the reservoir 150 to flow towards and into the internal cavity 140. Pressing down on the compressible portion 181 with the force F in the direction of the arrow temporarily increases the pressure in the reservoir 150. The compressible portion 181 preferably biases back to its normal structural configuration after the user stops applying the force F to the compressible portion 181 through the use of a proper pressure relief valve. It should be understood that any of the embodiments described herein may also include the one-way valve 161 to prevent the oral care material 141 from flowing back from the internal cavity 140 into the reservoir 150.

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Referring to FIGS. 4 and 5 concurrently, another embodiment of a toothbrush 400 in accordance with the present invention will be described. The toothbrush 400 is similar to the toothbrush 100 in many regards. Thus, similar features will be similarly numbered with the exception that the 400-series of numbers will be used. It should be understood that features and components of the toothbrush 400 that are not described in detail herein are the same as corresponding features and components of the toothbrush 100.

The toothbrush 400 comprises a body 405 having a handle 420 and a head 410 coupled to an end of the handle 420. The head comprises a front surface 411 and an opposing rear surface 412. Although not illustrated, the rear surface 412 may comprise a soft tissue cleaner, such as the soft tissue cleaner 114 described above. Furthermore, the front surface 411 of the head 410 comprises a plurality of tooth cleaning elements 416 extending outwardly therefrom. The tooth cleaning elements 416 are used for cleaning a user's teeth during an oral hygiene regimen.

The body 405 of the toothbrush 400 comprises an inner surface 417 and an outer surface 406. The inner surface 417 of the body 405 defines an internal cavity 440. In the exemplified embodiment, the internal cavity 440 is positioned within the head 410. However, the invention is not so limited and the internal cavity 440 may be otherwise located within the body 405 of the toothbrush 400. The internal cavity 440 contains an oral care material 441 therein, which may be any of one or a combination of the oral care materials described above.

In addition to the tooth cleaning elements 416, there is an upstanding collar 490 extending from the front surface 411 of the head 410. The upstanding collar 490 is a tubular structure having a cavity 491 therein and an opening 409 in a top end thereof. In the exemplified embodiment, the upstanding collar 490 is a cylindrical-shaped wall. Of course, the invention is not to be so limited and the upstanding collar 490 can take on any other shape and/or be omitted is desired. The cavity 491 is in fluid communication with the internal cavity 440 so that the oral care material 441 can flow from the internal cavity 440 and into the cavity 491. It is preferable that the cavity 491 remains filled with the oral care material 441 as will be described in more detail below.

A roll-on applicator 430 is rotatably mounted within the upstanding collar 490. More specifically, the roll-on applicator 430 is rotatably mounted to the upstanding collar 490 so as to enclose the opening 409. The roll-on applicator 430 can be mounted to the upstanding collar 490 by any means as would be known to persons skilled in the art, including the mating geometry discussed above or the use of an axle or posts. The roll-on applicator 430 is located on the front surface 411 of the head 410 and within the field of tooth cleaning elements 416. The roll-on applicator 430 extends from the head 410 in the same distance as the tooth cleaning elements 416 so that the roll-on applicator 430 can deliver the oral care material 441 to a user's oral surfaces.

The roll-on applicator 430 has an exposed portion 432 that is exposed to the external environment and an internal portion 433 that is in contact with the oral care material 441 within the cavity 491. As described above, the exposed and internal portions 432, 433 are not specific segments of the roll-on applicator 430. Rather, the exposed and internal portions 432, 433 of the roll-on applicator 430 merely refer to the portions of the roll-on applicator 430 that are exposed to the external environment and in contact with the oral care material 441, respectively, at any given time. Furthermore, it should be understood that the roll-on applicator 430 is capable of 360

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degrees of rotation about the X, Y and Z axes of a Cartesian coordinate in which the center of the roll-on applicator **430** is the 0-0-0 point.

In the exemplified embodiment, the roll-on applicator **430** comprises a single spherical element that is positioned within the field of tooth cleaning elements **416**. Of course, the invention is not so limited and the roll-on applicator **430** may comprise more than one spherical element or it may comprise elements that are shaped other than spherically, such as the cylindrically shaped elements described below with reference to FIG. 6. Furthermore, the positioning of the roll-on applicator **430** on the front surface **412** of the head **410** is in no way limiting of the present invention. In certain embodiment, the upstanding collar **490** can be omitted and the roll-on applicator can be partially embedded in the front surface **411** of the head **410**.

As described above, it is preferred that the cavity **491** remain filled with the oral care material **441** at all times. In this way, the internal portion **433** of the roll-on applicator **430** can be in constant contact with the oral care material **441** so that the roll-on applicator **430** can continuously deliver the oral care material **441** from the internal cavity **440** to a user's oral cavity. In order to maintain the cavity **491** filled with the oral care material **441**, any of the pressurizers described above may be used. Alternatively, any other method of keeping the cavity **491** filled with the oral care material **441** as may be known to persons skilled in the art can be used.

Referring now to FIG. 6, another embodiment of a toothbrush **600** according to the present invention will be described. The toothbrush **600** has many features that are similar to or the same as features of the toothbrush **100**. Thus, similar features will be similarly numbered with the exception that the 600-series of numbers will be used. It should be understood that features and components of the toothbrush **600** that are not described in detail herein are the same as corresponding features and components of the toothbrush **100**.

The toothbrush **600** generally comprises a body **605** having a head **610** and a handle **620**. The body **605** extends from a proximal end **601** to a distal end **602** along a longitudinal axis B-B. The head **610** comprises a front surface **611** and an opposed rear surface **612**. The rear surface **612** comprises a soft tissue cleaner **614**, such as the soft tissue cleaner **114** described above. The front surface **611** comprises a plurality of tooth cleaning elements **616** extending outwardly therefrom for engaging a user's teeth during a toothbrushing session.

The toothbrush **600** comprises a roll-on applicator **630**. However, rather than spherical elements, the roll-on applicator **630** of the toothbrush **600** comprises a plurality of cylindrical elements, including a first cylindrical element **630a**, a second cylindrical element **630b** and a third cylindrical element **630c**. The details of the cylindrical elements **630a-c** will be described below with reference to the first cylindrical element **630a**. However it should be understood that the details discussed herein regarding the first cylindrical element **630a** is equally applicable to the second and third cylindrical elements **630b**, **630c**.

The first cylindrical element **630a** comprises a longitudinal axis C-C that is perpendicular or transverse to the longitudinal axis B-B. The first cylindrical element **630a** is rotatably mounted to the body **605** so as to be capable of 360 degrees of rotation about the longitudinal axis C-C (which is also the axis of rotation of the first cylindrical element **630a**). In the exemplified embodiment, the first cylindrical element **630a** is rotatably mounted to the rear surface **612** of the head **610**. Of course, as has been described above, the invention is not so

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limited and the cylindrical elements **630a-c** can be mounted at any location on the body **605** including, for example, on the front surface **611** of the head **610** or on the handle **620**. The cylindrical elements **630a-c** act and function in a manner similar to the spherical elements **130a-c** of the roll-on applicator **130** discussed above except that the cylindrical elements **630a-c** are more limited in their rotational degrees of freedom. Thus, the entire description of the oral care material delivery of the spherical elements **130a-c** is fully applicable to the cylindrical elements **630a-c** of the roll-on applicator **630**.

A method of applying an oral care material to an oral surface of a user will now be described. The method will be described with reference to the reference numerals from the toothbrush **100**. However, it should be understood that the other embodiments can also be used with the method. The toothbrush **100** with the roll-on applicator **130** rotatably mounted thereto is positioned so that the roll-on applicator **130** is in contact with the user's oral surface. Then, the toothbrush **100** is used such that relative movement between the toothbrush **100** and the oral surface of the user is created while maintaining the roll-on applicator **130** in contact with the user's oral surface. As such, the roll-on applicator **130**, or more specifically the spherical elements **130a-c** of the roll-on applicator **130**, are caused to rotate relative to the body **105** of the toothbrush **100** to thereby deliver the oral care material **141** from the internal cavity **140** to the user's oral surface. The relative movement described above can be achieved from a normal toothbrushing movement, such as a back-and-forth axial movement along the longitudinal axis B-B or a circular motion as would be known to persons skilled in the art. By using the toothbrush **100** as described above, the rotation of the spherical elements **130a-c** of the roll-on applicator **130** cause the oral care material **141** within the internal cavity **140** to be delivered to the exposed portion **132a-c** of the spherical elements **130a-c** of the roll-on applicator **130**. In turn, the exposed portions **132a-c** of the spherical elements **130a-c** of the roll-on applicator **130** contact the oral surface of the user to apply the oral care material **141** to the user's oral surfaces.

As used throughout, ranges are used as shorthand for describing each and every value that is within the range. Any value within the range can be selected as the terminus of the range. In addition, all references cited herein are hereby incorporated by referenced in their entireties. In the event of a conflict in a definition in the present disclosure and that of a cited reference, the present disclosure controls.

While the foregoing description and drawings represent the exemplary embodiments of the present invention, it will be understood that various additions, modifications and substitutions may be made therein without departing from the spirit and scope of the present invention as defined in the accompanying claims. In particular, it will be clear to those skilled in the art that the present invention may be embodied in other specific forms, structures, arrangements, proportions, sizes, and with other elements, materials, and components, without departing from the spirit or essential characteristics thereof. One skilled in the art will appreciate that the invention may be used with many modifications of structure, arrangement, proportions, sizes, materials, and components and otherwise, used in the practice of the invention, which are particularly adapted to specific environments and operative requirements without departing from the principles of the present invention. The presently disclosed embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being defined by the appended claims, and not limited to the foregoing description or embodiments. For example, in certain embodiments, the

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delivery of the oral care fluid from the reservoir to the applicator can be supplemented by mechanical action if desired.

What is claimed is:

1. An oral care implement comprising:

a body comprising a handle, a head coupled to the handle, and an internal cavity containing an oral care material; a roll-on applicator rotatably mounted to the body, such that the oral care material is delivered from the internal cavity to an exposed portion of the roll-on applicator due to rotation of the roll-on applicator; and

a field of tooth cleaning elements extending from a front surface of the head, wherein the roll-on applicator is located on at least one of: (1) a rear surface of the head opposite the front surface; and (2) the front surface of the head and within the field of tooth cleaning elements.

2. The oral care implement according to claim 1 wherein the exposed portion of the roll-on applicator protrudes from an outer surface of the body and an internal portion of the roll-on applicator contacts the oral care material within the internal cavity.

3. The oral care implement according to claim 1 wherein the roll-on applicator comprises at least one spherical element rotatably mounted to the body.

4. The oral care implement according to claim 3 wherein the at least one spherical element is mounted in a socket formed in the body.

5. The oral care implement according to claim 1 wherein the roll-on applicator comprises at least one cylindrical element rotatably mounted to the body.

6. The oral care implement according claim 1 wherein the roll-on applicator is located on a longitudinal axis of the oral care implement.

7. An oral care implement comprising:

a body comprising a handle, a head coupled to the handle, and an internal cavity containing an oral care material; a roll-on applicator rotatably mounted to the body, such that the oral care material is delivered from the internal cavity to an exposed portion of the roll-on applicator due to rotation of the roll-on applicator; and

a soft tissue cleaner comprising one or more protuberances, the roll-on applicator positioned within the soft tissue cleaner.

8. The oral care implement according to claim 1 wherein the internal cavity is located within the head.

9. The oral care implement according to claim 1 further comprising a pressurizer that pressurizes the oral care material within the internal cavity so that the oral care material maintains contact with the roll-on applicator.

10. The oral care implement according to claim 9 wherein the pressurizer comprises one of a movable piston or a user-operable pump.

11. The oral care implement according claim 9 further comprising a reservoir containing the oral care material in the body, the reservoir being in fluid communication with the internal cavity.

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12. The oral care implement according to claim 11, wherein the pressurizer pressurizes the oral care material within the reservoir, thereby supplying the oral care material from the reservoir to the internal cavity to maintain contact with the roll-on applicator.

13. The oral care implement according to claim 11 further comprising a one-way valve operably coupled between the reservoir and the internal cavity that allows flow of the oral care material from the reservoir to the internal cavity while prohibiting flow of the oral care material from the internal cavity to the reservoir.

14. The oral care implement according to claim 1 wherein the roll-on applicator is rotatably mounted to the body so as to be capable of at least 360 degree rotation about an axis extending substantially perpendicular to a longitudinal axis of the oral care implement.

15. An oral care implement comprising:

a body comprising a handle, a head coupled to the handle, and an internal cavity containing an oral care material; a roll-on applicator rotatably mounted to the body, such that the oral care material is delivered from the internal cavity to an oral surface of a user due to rotation of the roll-on applicator; and

a field of tooth cleaning elements extending from a front surface of the head, wherein the roll-on applicator is located on at least one of: (1) a rear surface of the head opposite the front surface; and (2) the front surface of the head and within the field of tooth cleaning elements.

16. The oral care implement according to claim 15 wherein an exposed portion of the roll-on applicator protrudes from an outer surface of the body and an internal portion of the roll-on applicator contacts the oral care material within the internal cavity.

17. The oral care implement according to claim 15 wherein the roll-on applicator comprises one or more spherical elements rotatably mounted to the body.

18. The oral care implement according to claim 17 wherein each of the one or more spherical elements is mounted in a socket formed in the body.

19. An oral care implement comprising:

a body comprising a handle, a head coupled to the handle, and an internal cavity containing an oral care material; a roll-on applicator rotatably mounted to the body, such that the oral care material is delivered from the internal cavity to an oral surface of a user due to rotation of the roll-on applicator; and

a soft tissue cleaner comprising one or more protuberances, and the roll-on applicator positioned within the soft tissue cleaner.

20. The oral care implement according to claim 15 further comprising a pressurizer disposed within the body, the pressurizing being capable of pressurizing the oral care material within the internal cavity so that the oral care material remains in fluid communication with the roll-on applicator.

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